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A Year Experience with the Air Quality Index System for Ontario

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1. Introduction

In order to better inform the public on the quality of Ontario's air, a new Air Quality Index (AQI) was implemented in May-June of 1988. The AQI system offers a comprehensive coverage consisting of 33 monitoring sites in 26 cities across the province. The index cities are Metropolitan Toronto (consisting of Toronto, East York, North York, York, Etobicoke and Scarborough), Hamilton, Windsor, Sarnia, Sudbury, St. Catharines, Niagara Falls, London, Kitchener, Waterloo, Guelph, Burlington, Oakville, Oshawa, Mississauga, Sault Ste Marie, Thunder Bay, North Bay, Cornwall, Ottawa and Kingston. The system provides hourly information for six basic pollutants (sulphur dioxide (SO_2), suspended particles (SP), nitrogen dioxide (NO_2), ozone (O_3), carbon monoxide (CO), and total reduced sulphur compounds (TRS)) and informs the public on a real-time basis. The previous Air Pollution Index (API), a combination of SO_2 and SP, still serves as a regulatory tool and in addition, is incorporated as a sub-index of the AQI system.

2. The Air Quality Index

The Ontario AQI (Shenfeld, 1987; Shenfeld and Yap, 1989) is similar in design to that of the Canadian Index of the Quality of Air (Young et al., 1977) and that of the U.S. EPA Pollutant Standards Index (Ott and Hunt, 1976). The descriptive categories and numerical values, however, are related to Canadian standards (Federal and Ontario) which differ from that of the United States for each of the pollutants. A sub-index ranging from zero upwards is related to the hourly concentration of each of the pollutants. As the index increases, the air quality decreases. The sub-index is calculated for each pollutant based on its effect and the highest sub-index at any time becomes the AQI.

The Index values are divided into five descriptive categories and reflects possible effects on health, vegetation, property, and aesthetic values.

| | |
|---------|-----------|
| 0 - 15 | very good |
| 16 - 31 | good |
| 32 - 49 | moderate |
| 50 - 99 | poor |
| ≥ 100 | very poor |

3. The Telemetry System

A new air quality telemetry system has been acquired and implemented to handle the vast amount of data collected. This system logs, transmits, and processes air quality and meteorological data from 120 monitoring stations across the province. Each instrument is interrogated every two seconds and five-minute averages are stored at local loggers and are thus available to local air

pollution control agency personnel. The data is then automatically transmitted from each of six regional processing units to the Ontario Air Quality Computer Center in Toronto. Here, hourly and other cumulative hourly averages, the AQI, the API, and as well, hourly, daily, and monthly reports are generated. The performance of the system is reflected in the success rate of obtaining good quality data. Over the past year, the validity of data was over 95% for most locations. An example of the percentage of time that valid 0, readings were obtained to produce the AQI is shown in Fig.1.

4. Publicizing the Index

The AQI levels for each City are currently sent to the new media eight times daily at the following hours:

Midnight, 4:00 A.M., 6:00 A.M., 7:00 A.M., 11:00 A.M., 2:00 P.M., 4:00 P.M. and 8:00 P.M. except when the index at a location is 32 or above. When this occurs, the index is issued hourly until the air quality improves to the Good range (i.e. < 32). Air quality forecasts are also issued four times daily (7:00 A.M., 11:00 A.M., 2:00 P.M. and 4:00 P.M.). An example of an air quality forecast is given below:

AIR QUALITY INDEX FORECAST FOR: THURSDAY, SEPTEMBER 21, 1989

Generally good to very good. Possibility of moderate levels due to SP at some sites of southern Ontario this morning and a slight possibility of moderate levels due to TRS at Cornwall.

There is much interest in the index from the media and the public when the air quality is in the Moderate and Poor ranges.

5. AQI Data Analysis

Data for the 12 month-period June 1988 to May 1989 were analysed. In general, Good to Very Good air quality levels (AQI < 32) prevailed at all sites throughout the province for most of the year (96% of the time or better). Elevated air quality levels occurred at all sites, except Thunder Bay in northwestern Ontario. Fig.2 shows the frequency that AQI levels were in the Moderate and Poor ranges at each of 21 cities (only downtown locations in Metro Toronto, Hamilton and Windsor). There were no incidences of Very Poor air quality reported at any location. As can be seen from Fig.3, ozone is by far the most frequent cause of high index readings in Ontario (74%). This was followed by suspended particles (16%) and total reduced sulphur compounds (8%).

The ozone excursions, confined to the warm season, were often widespread and associated with long-range transport of air pollutants into and across southern Ontario. There appears to be also some contribution of local sources to the elevated ozone levels, especially across or near highly urbanized areas of the province. On a number of occasions, moderate AQI values were associated with nocturnal O₃ exceedances, especially in northeastern Ontario. The incidences of SP excursions occurred throughout the year with some bias towards the morning

hours of peak traffic, low-level temperature inversions, and light winds. For TRS, excursions were more localized to areas associated with pulp and paper, petroleum refineries, and iron and steel industries. On a few occasions, moderate AQI levels were associated with SO₂ in Sudbury and with the API in Hamilton. Carbon monoxide and nitrogen dioxide did not result in a high index reading during the study period.

Concluding Remarks

The new Air Quality Index system in Ontario has been successfully implemented and has been in operation for over a year now. It has been used to better inform the public on the quality of Ontario's air on a real-time basis, 24 hours per day, seven days per week.

References

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PERCENTAGE OF VALID AQI DATA FOR OZONE
IN ONTARIO (JUNE 88-MAY 89)

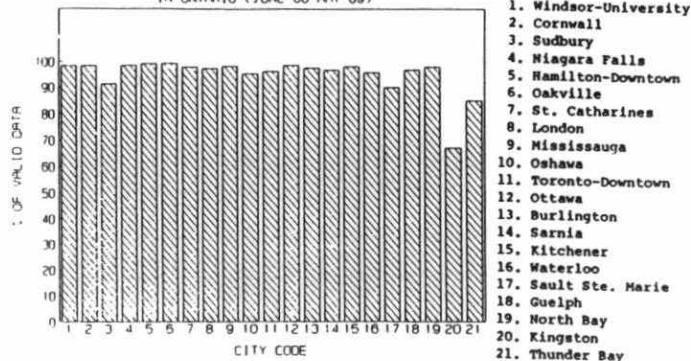


Fig. 1

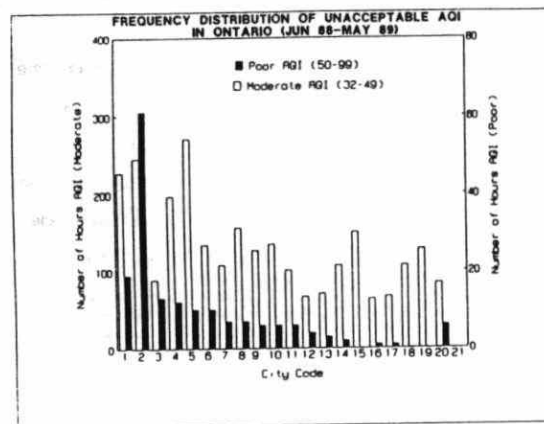


Fig. 2

PERCENTAGE OF FREQUENCY (AQI > 32) JUN 88-MAY 89

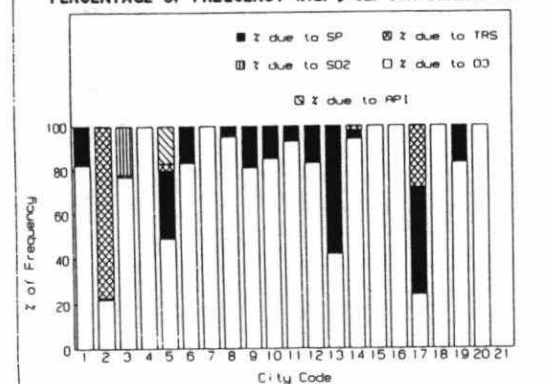


Fig. 3

1. Windsor-University
2. Cornwall
3. Sudbury
4. Niagara Falls
5. Hamilton-Downtown
6. Oakville
7. St. Catharines
8. London
9. Mississauga
10. Oshawa
11. Toronto-Downtown
12. Ottawa
13. Burlington
14. Sarnia
15. Kitchener
16. Waterloo
17. Sault Ste. Marie
18. Guelph
19. North Bay
20. Kingston
21. Thunder Bay

